Development of an ASC For Riverine Sensing

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LONG-TERM GOALS

The long-term goals to be derived from this effort include expanding the ability to employ autonomous and remotely operated unmanned platforms in a wide array of oceanographic and surveillance applications. Prior experience with unmanned surface vessels has demonstrated the clear utility of these low-cost platforms in performing a wide variety of at-sea missions including adaptive sampling, mine countermeasure duties and anti-submarine warfare applications. Aside from proving their usefulness for augmenting and expanding the reach of the oceanographer, these platforms have been used extensively as surrogates for the more costly AUV platforms both for software development and direct application. It is envisioned that this effort will continue to push the evolution of these highly valuable assets to further leverage the rapidly growing field of marine autonomy and likely fulfill roles in future applications not yet conceived.

OBJECTIVES

It is the objective of this proposal to advance the existing design of the ASC kayak platform previously developed by RMS, so that it is capable of satisfying specific river based operations. In order to meet the technical requirements imposed by the installation and operation of user-selected ADCP (Acoustic Doppler Current Profiling) payloads, certain modifications and improvements to the existing ASC kayak will be performed. Some of the advanced features to be incorporated into this design will include an improved main vehicle computer (MVC), a low power watchdog circuit, improved power management hardware/firmware, watertight integrity (NEMA IP67 rated enclosures and connectors) and provision for the mechanical and electrical integration of a user specified ADCP payload.

Scientific or Technological Objectives of this effort.

This effort represents a foray into a new area of use for the ASC SCOUT vehicle through the integration of the RDI ADCP and DVL sensors. It is intended that this vehicle will prove to provide a more efficient means for obtaining reliable three-dimensional current profiling. In addition to reducing the manning requirements, the autonomous platform will perform despite being exposed to dangerous, mundane or otherwise undesirable work conditions. The autonomous platform also inherently provides additional sensory data including pitch, roll and yaw as well as differential GPS and accelerations in three axis if desired. The ASC SCOUT vehicle has additional payload capacity which may be used to include other third-party sensors such as CTD, DO and others. This effort aims to demonstrate the utility of using this platform in conjunction with other oceanographic sensors and to demonstrate the benefits that may be gained through leveraging the existing autonomous behaviours that may be employed with this vehicle.

APPROACH

This effort proposes to fabricate two working vehicles and perform the necessary design and integration services to support the installation, testing and initial field deployment of a user specified ADCP payload. Included in the core effort will be the necessary advanced engineering design and fabrication efforts to integrate the payload mounting and electrical connection into the MVC. The core vehicles will be produced as per the existing vehicle specifications and include the modifications specific to integrating the ADCP payload.

Key Personnel

Joseph A. Curcio

M.S., Ocean Systems Management, M.Eng., Ocean Engineering, MIT, 1995.

Mr. Curcio received his Master's of Engineering and Master's of Science in Ocean Engineering and Ocean Systems Management from MIT in 1995. Prior to studying at MIT, Mr. Curcio received his Bachelor's of Science in Mechanical Engineering at the University of Vermont.

Publication List: http://maribotics.com/publications/Publication List.pdf
Online CV: http://maribotics.com/publications/curcio_resume.pdf

Andrew Patrikalakis

Mr. Patrikalakis has worked in the field of ocean engineering for several years in thecapacity of systems integration and design and engineering support. His skills includeproficient knowledge of numerous operating systems and programming languages and the design and fabrication of a wide array of electronic circuits. He brings with him an intimate knowledge of the interface between hardware and software and has extensive at-sea experience.

Toby Schneider

Massachusetts Institute of Technology (MIT) / Woods Hole Oceanographic Institution (WHOI): http://aubergine.whoi.edu/

Mr. Schneider is currently a PhD candidate in the MIT/WHOI Joint Program in Oceanography and Applied Oceans Sciences and Engineering. He has participated in several significant field experiments involving the autonomous surface craft to be used in this proposed work. He is one of the most experienced engineers in regard to the current implementation and use of MOOS and MOOS-IvP on these craft. He has written MOOS modules for projects ranging from target tracking to adaptive oceanographic sampling.

Jacques Leedekerken

M.Eng Electrical Engineering and Computer Science, MIT, 2005
B.S Electrical Engineering and Computer Science, MIT, 2005
B.S Management Science, MIT, 2003

Mr. Leedekerken has extensive experience in areas of signal processing and autonomous land and marine vehicles, and he has 4+ years experience developing within the MOOS software architecture. He has worked with a variety of marine vehicle platforms and sensors. His prior work includes development of real-time forward-look sonar SLAM (Simultaneous Localization and Mapping) for both AUVs and the ASC SCOUT, where data filtering, fusion, and management are essential. He worked as a lead developer in an ONR funded project Feature Based Navigation for Target Reacquisition, where a low-cost AUV would localize underwater within a prior map and then proceed to a terminal capture of a designated target. Mr. Leedekerken also demonstrated short-baseline acoustic tracking with two autonomous SCOUT vehicles.

WORK COMPLETED

Contract not yet awarded.

RESULTS

Contract not yet awarded.

IMPACT/APPLICATIONS

The utility of autonomous marine vehicles has been demonstrated through numerous in-water field deployments, but we have only begun to scratch the surface regarding the future potential of robotic and autonomous platforms in the marine environment. Aside from performing reliably without the need for human intervention, robotic platforms perform with precision and repeatability limited only by their design and programming. Typical applications will include adaptive remote sampling, detection of oceanographic events (tsunami early warning, etc.) and more.

TRANSITIONS

To be determined

RELATED PROJECTS

Robotic Marine Systems has recently been awarded a contract to fabricate several ASC vehicles for a customer in Singapore. Among the uses proposed by this customer, the installation of a DVL sensor similar to that proposed here is anticipated for installation in one or more vehicles. It is not clear to personnel at RMS exactly how this customer intends on using the ASC SCOUT once equipped with the DVL, but it appears to be as part of an effort to develop underwater navigaiton capapbility and not in the more conventional applied oceanography.

REFERENCES

None to Report.

PUBLICATIONS

None to Report

PATENTS

None to Report

HONORS/AWARDS/PRIZES

None to Report